Do BL Lac objects fit on the fundamental plane?

Plotkin, Richard; Markoff, Sera; Kelley, Brandon; Koerding, Elmar; Trager, Scott

Published in:
38th COSPAR Scientific Assembly. Held 18-15 July 2010, in Bremen, Germany, p.6

38th COSPAR Scientific Assembly 2010

Research in Astrophysics from Space (E)
Accretion on Compact Objects and Fast Phenomena in Multiwavelength Era (E13)

DO BL LAC OBJECTS FIT ON THE FUNDAMENTAL PLANE?

Richard Plotkin, r.m.plotkin@uva.nl
University of Amsterdam, Amsterdam, The Netherlands
Sera Markoff, s.b.markoff@uva.nl
University of Amsterdam, Amsterdam, The Netherlands
Brandon Kelley, bckelly@cfa.harvard.edu
Harvard-Smithsonian Center for Astrophysics, United States
Elmar Koerding, elmar@koerding.eu
AIM - Universite Paris 7 CEA Saclay, Gif-sur-Yvette, France
Scott Trager, sctrager@astro.rug.nl
Kapteyn Astronomical Institute, University of Groningen, The Netherlands

The fundamental plane of black hole accretion–a correlation between radio luminosity, X-ray luminosity, and black hole mass–expresses the connections between accretion physics over at least eight orders of magnitude in black hole mass. We first present an updated regression analysis of the fundamental plane utilizing a Bayesian approach. We then present new results on our attempts to place BL Lac objects on the fundamental plane. BL Lac objects are interpreted in the standard model as low-luminosity radio galaxies viewed nearly along the axis of a relativistic jet. They might be excellent high-mass analogs ($\sim 10^8$-10^9 solar masses) to hard-state X-ray binaries because their spectral energy distributions are jet dominated. Also, they likely have weak broad emission line regions, meaning their environments are relatively uncomplicated compared to other classes of Active Galactic Nuclei (AGN) with similarly massive black holes. We consider around 10^2 BL Lac objects here (taken from a much larger 723 object SDSS BL Lac sample) for which we measure black hole masses, and for which we have radio, optical, and X-ray flux measurements. Even just this subset of 10^2 BL Lac objects is larger than entire XRB/AGN samples used in previous fundamental plane studies. Our BL Lacs generally fit on the fundamental plane, albeit with scatter. We investigate potential sources of this scatter, such as the importance of relativistic beaming. We also discuss if objects deviate from the plane as a function of their synchrotron cutoff frequency, which could be interpreted as variations in the strengths of their broad emission line regions (i.e., environment) and/or in accretion rate.